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**13. ABSTRACT** *(Maximum 200 words)*
We have received funds to purchase a variable-temperature, UHV, STM-AFM system with an UHV analytical chamber. The instrument has been purchased and installed and is now working. Fig. 1 shows the microscope and the UHV analytical chamber. The instrument consists of a chamber with a STM and an AFM microscope. The sample can be cooled in the range 30 K to 1000 K. Pictures can be taken at constant temperature. The sample is mounted on a manipulator that can move it in a UHV chamber where we have: sources for metal vapor deposition (to form clusters on the surface), thermal desorption, ion gun (for sample cleaning by sputtering), Auger spectrometer (to monitor surface composition and cleanliness), gas dosers (to adsorb gases on the surface), and thermal desorption equipment. All these and a variety of peripherals (computers, pumps, gauges, etc) have been purchased with funds from the grant.

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**Final Technical Report, AFOSR grant F49620-01-1-0379 (equipment)**
"Catalysis By Nanostructures: methane, ethylene oxide, and propylene oxide"

We have received funds to purchase a variable-temperature, UHV, STM-AFM system with an UHV analytical chamber. The instrument has been purchased and installed and is now working. Fig. 1 shows the microscope and the UHV analytical chamber. The instrument consists of a chamber with a STM and an AFM microscope. The sample can be cooled in the range 30 K to 1000 K. Pictures can be taken at constant temperature. The sample is mounted on a manipulator that can move it in a UHV chamber where we have: sources for metal vapor deposition (to form clusters on the surface), thermal desorption, ion gun (for sample cleaning by sputtering), Auger spectrometer (to monitor surface composition and cleanliness), gas dosers (to adsorb gases on the surface), and thermal desorption equipment. All these and a variety of peripherals (computers, pumps, gauges, etc) have been purchased with funds from the grant.

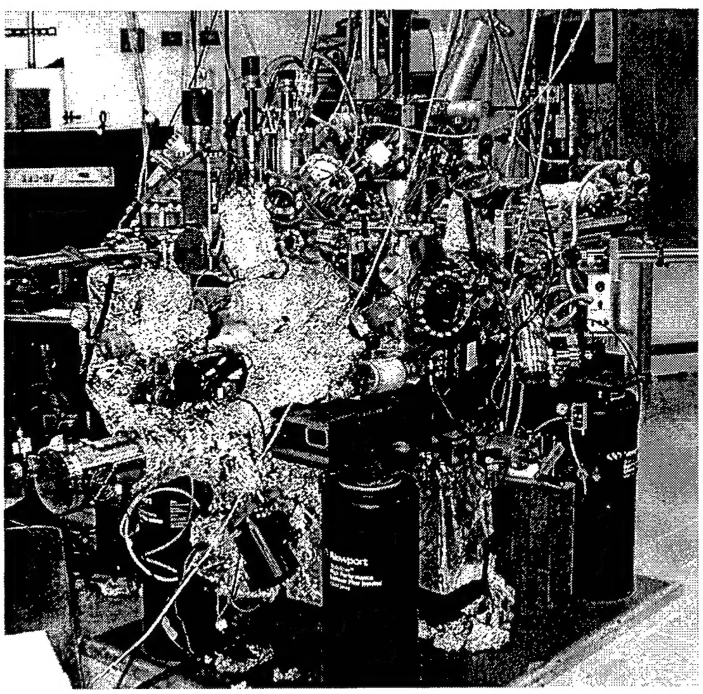


**Figure 1. The RHK, variable temperature, ultra-high vacuum microscope (at the left) and the analytical chamber for sample preparation (at the right)**

The instrument works very well, as one can see from Figs. 2-4.

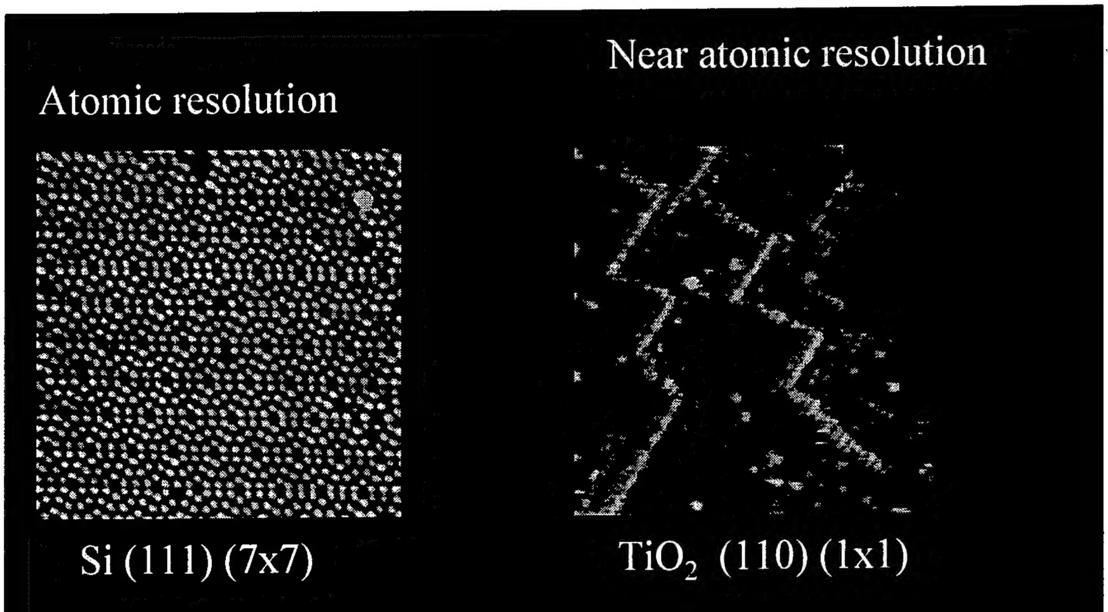
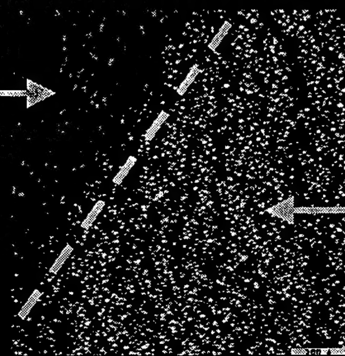



Figure 2. Left: an image of the Si(111) 7X7 with atomic resolution. Right: an image of the $TiO_2$ (110) 1X1 rutile surface, with near-atomic resolution. The red rows are the 5-coordinated Ti atoms and the dark ones are the oxygen atoms.

## Surface nanostructuring for investigation of cluster nucleation, temperature and gas induced coarsening




*In vivo* nucleation and growth individual as well as an ensemble of the particles

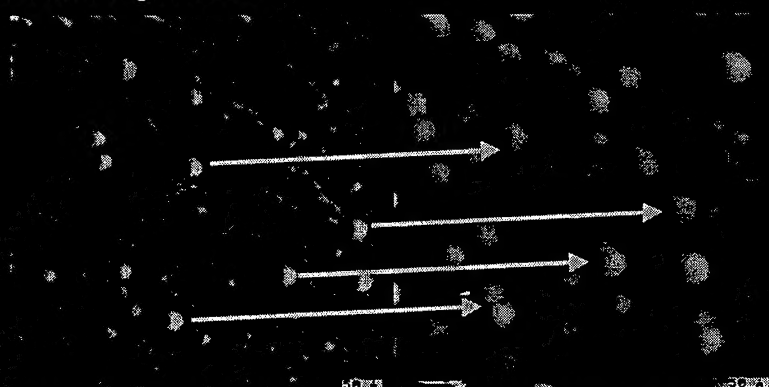



**Fig. 3. Nucleation and growth of Ag clusters on a $TiO_2$ surface**

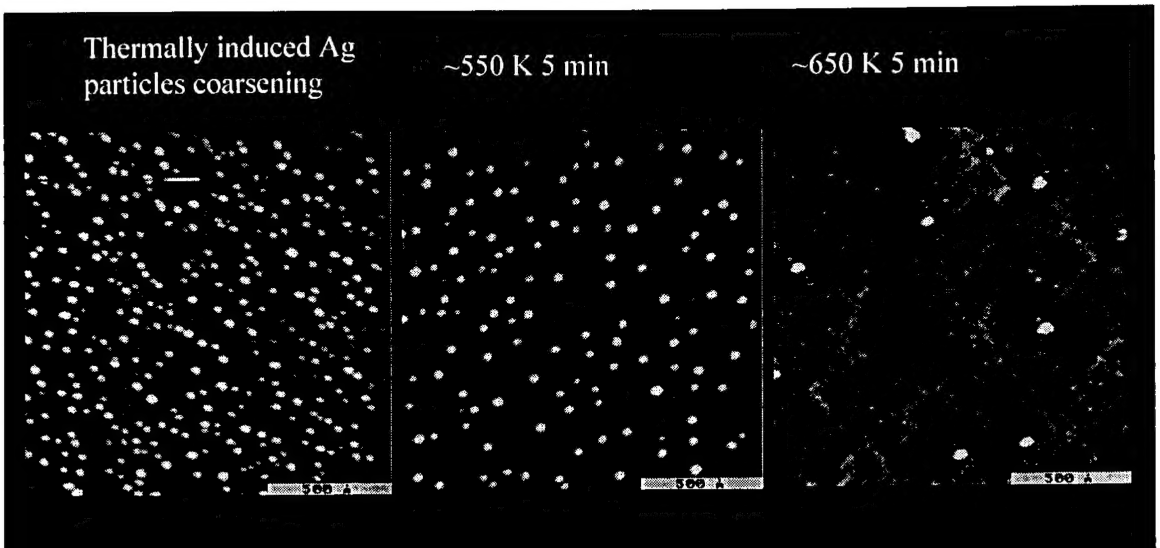



**Figure 4: Left panel: Au particles on $TiO_2$ (110) 1X1 surface, immediately after deposition. Middle panel: Au particles after heating at 550K for 5 minutes. Right panel: Au particles after further heating to 650 K for 5 minutes.**